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AUTHOR Neukater, Heinz
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ABSTRACT

Six children (mean age 10 years) with minimal brain dysfunction learned to regulate their behavior for themselves and showed less disturbed behavior, increased on-task behavior and better mathematics performance under conditions of self control. (C.)

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Heinz Neukäter

Teaching self-control in mathematics to behavior disturbed minimally brain damaged children

1. Problem

Empirically controlled educational programs with supposed MBD children support a highly structured learning environment (Cruickshank et al., 1961; Hewett, 1968; Neukäter & Goetze, 1978). In these settings all activities of students are teacher controlled. On the other hand there is some empirical evidence, that behavior disturbed children can perform as well or better under conditions of self-control than under conditions of external control (Drabman et al., 1973). Single case studies with diagnosed minimally brain damaged and hyperactive children also support the notion, that even these children can learn to control behavior disturbances for themselves (Neukäter, 1976).

This study was designed to analyze, if a group of MBD children in a learning disability classroom can learn to regulate their behavior disturbances, their on-task behavior and can achieve better success in mathematics under conditions of self-directed learning. If we should succeed in teaching them new behavior successfully, we hope to find new perspectives in teaching the minimally brain damaged child.

2. Method

2.1. Subjects

Subjects were six children of a learning disability class in a psychiatric hospital. This institution has been serving children with supposed MBD. Psychopathological evaluation were done by EEG, GFT (Schlange et al., 1973) and history of diseases. Data confirmed the assumption of a minimal brain dysfunction for five children chequed by EEG and for all six students, chequed by GFT and personal history. The mean age of the subjects was 1o;4 years, their IQs ranged from 88 to 1o8 (Wechsler IQ).

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2.2. Observation measures

Students' behavior were categorized in four behavior classes:

- self stimulation
- distraction
- noise producing
- on-task behavior

Reactions to internal stimulations were called self-stimulations; e.g. nail biting, sucking, scratching, playing with pencils for fine motor activities; turning the head, moving chair and table, moving around, swinging arms and feet for gross motor activities.

Distraction was categorized as reactions to environmental non-task orientated stimulation, e.g. looking around at other students, or other incidents unconnected with the learning situation, listening to stimuli not introduced by the teacher.

Noise producing was defined as verbal or mimical activities and insulting behavior which interrupted on-task activities, e.g. singing, crying, whistling, shouting.

On-task behavior was defined as looking at the teacher or the work materials, writing and drawing, counting, asking and answering questions, listening to what peers and teachers are saying, helping other students etc.

An observation period for each child consisted of 1o intervalls each lasting for 15 seconds. The observation/record interval was on a ten/five second base (observation/record). The students were randomly observed by trained independent persons.

A second source of data were the frequencies of problems solved correctly and mistakes made during 15 minutes of math assignements.

2.3. Procedure

To answer the question, if MBD children can be taught self-regulative behavior, a multiple baseline design was chosen. The experimental plan consisted of five phases of reinforcement. Each phase lasted for five lessons. In baseline (phase 1) students were taught without a systematic application of reinforcers.

Phase 2 consisted of a structured learning approach within a teacher directed token economy. During the phase of written exercises (the third part of the math lesson, 15 minutes) students got tokens equivalent to their performances. After doing 8/1o tasks, students got one toy-brick. Students were asked to solve 24/3o assignements. If they succeeded in solving more problems than 24/3o, they got a toy-brick extra. The beginning of work was reinforced, too.

The third phase includes students' participation in reinforcement delivery. 1o toy-bricks were placed in a small box. After a fixed ratio of problems solved, students could take a brick for themselves; but they had to ascertain that the teacher would accept. If students solved more problems than required, extra reinforcers could be taken.

During the fourth reinforcement condition students chose their reinforcers for themselves. Again 1o bricks were placed in a small box. At the beginning of the training in self-control students were asked to fix their criterion, that is the number of arithmetic problems, they wanted to solve within the time limits. This phase was called self-controlled learning phase.

The fifth phase was completely identical with the fourth one. It began 1½ weeks after the end of the fourth phase.

Following the wishes of the students the earned tokens could be exchanged in back-up reinforcers like

- going for a swim
- playing football
- eating ice cream in a restaurant.

These back-ups would be applied at the end of a week. If the student got 4 of 5 (phase 2) and 8 of 1o bricks (phases 3-5), he could participate in activity-reinforcers.

Each math lesson consisted of 3 phases of instruction, each of 15 minutes duration. The lessons opened with counting by heart. The second instruction phase consisted of problem solving. Teacher and students together tried to solve arithmetic problems. The third instruction phase finally helped students to train written exercises. Assignements were chosen individually and addressed to the knowledge of the students. Arithmetic tasks were taken from addition, subtraction, multiplication and division. In all phases of the project self-made assignements and programmed materials were used.

The program of teaching self-control was applied in an usual classroom. Each student worked at a desk for himself. Training in self-control was implemented during the third part of each lesson (written exercises).

3. Results

Reliability checks were conducted several times during the project. The overall percentage of observer agreement was never smaller than 90%.

Table 1 presents the means of arithmetic tasks completed and percentages of mistakes during the written exercises phase. Data of table 1 show that the mean number of assignements solved changed between the conditions of reinforcement. During baseline phase we observed 25.5, during external control (phase 2)

Table 1

Mean number of tasks completed and percentages of mistakes in 15 minutes during various conditions of reinforcement

Conditions	1	2	3	4	5
Tasks completed	25.5	21.6	23.4	30.3	30.6
Mistakes (%)	15.5	16.7	8.8	7.5	5.2

21.6 and during self-control phases about 30 tasks completed. Percentages of mistakes fell from 15.5 in baseline to 7.5 and 5.2 in the conditions of self-controlled learning.

Significant differences of the mean number of problems solved were found between phase 1 and phases 4/5 on the one hand and between phase 2 and phases 4/5 on the other hand (t-tests). Differences between baseline and the conditions of self-controlled learning showed a significant tendency ($p < .10$). The percentages of mistakes were different between phases 1 and 5, as well as between phases 4 and 5.

Fig. 1 presents the means of on-task behavior in %. Under baseline conditions we found a level of 59.1% of on-task behavior during written exercises. In phase 2 (teacher control) on-task behavior was observed more than 81% of the time, under the conditions of self-control 94.3 (phase 4) and 93 % (phase 5). Similar trends of on-task behavior will be found for problem solving and counting by heart. In general on-task behavior seemed to be higher in written exercises than in problem solving and counting by heart.

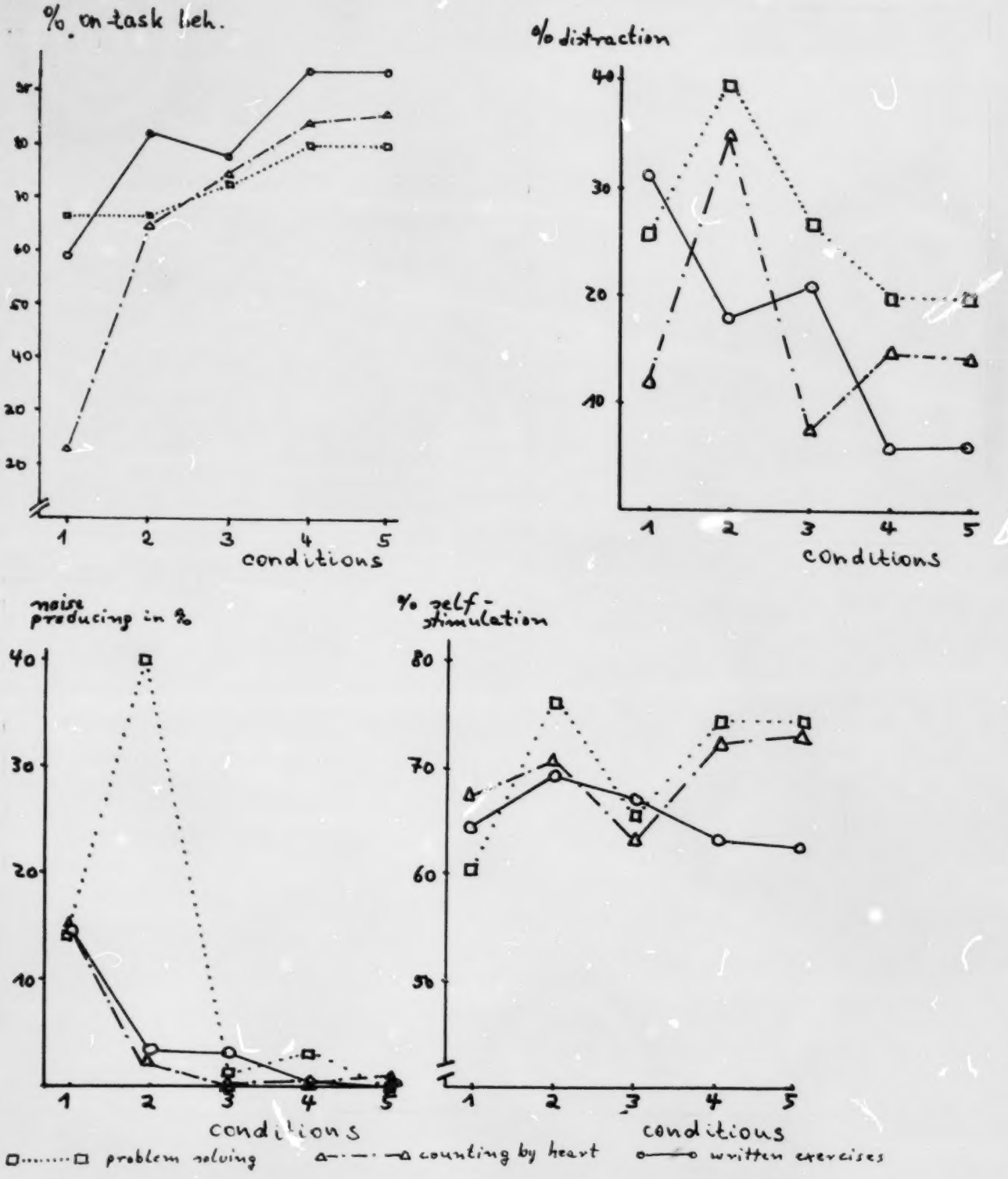

Fig. 1

Mean on-task behavior, distraction, noise producing and self-stimulation in % during 5 reinforcement conditions and 3 instructional phases

A statistical analysis of data was done by a twofold analysis of variances for repeated measures. Significant differences were found between the conditions of reinforcement ($p<.001$) and the conditions of instruction ($p<.001$). Even an interactive effect could be observed ($p<.05$). Further statistical analysis of data (t-tests) indicate that self-controlled learining (written exercises) improved significantly compared to baseline and teacher control. Similar results were found for the other phases of instruction (counting by heart, problem solving).

Distraction was observed 31.3% of the time in baseline, dropped to 18.2% in phase 2 and finally to near 6 % of the time in phases 4/5.

During the instructional phases 'problem solving' and 'counting by heart', distraction was generally higher under conditions of teacher control than baseline conditions and lower under conditions of self-control. Analysis of variances indicated that reinforcement conditions and phases of instruction differed significantly ($p<.001$). Interactive effects were significant on a 99 % level.

The behavior category of noise producing was observed near 15 % of the time under baseline condition. This behavior was reduced under conditions of teacher control and self-control (written exercises, counting by heart) to near zero. Problem solving too was influenced after a strong amount under teacher controlled conditions. Statistical analysis again indicated, that reinforcement conditions differed significantly ($p<.001$).

Self-stimulation was observed between 6o and 8o % of the time during the various reinforcement conditions and phases of instruction. A twofold analysis of variances didn't indicate, that behavior had been influenced significantly.

We can conclude from data:

- MBD children can learn to regulate behavior for themselves.
- MBD children show less disturbed behavior (distraction, noise producing), more on-task behavior and better performances (more problems solved, fewer mistakes) under conditions of self-control.
- A training of self-control in written exercises generalizes to other instruction phases, in which a training was not initiated.

4. Discussion

The designed study tried to find out, if supposed MBD students can be taught to manage their behavior on their own. Data confirmed the assumption that students can be trained successfully in self-control, after a teacher controlled token program was introduced.

Under conditions of self-control MBD students were found to work harder than under conditions of baseline and teacher control. Students showed more on-task behavior, fewer behavior disturbances and better performances in mathematics. Similar results have been found in other studies with behavior disturbed students (Drabman et al., 1973). So it can be concluded that even MBD students can learn to be responsible for themselves, although one may expect, that description of MBD excludes this capacity.

An advantage of this study was the fact that self-controlled learning was trained in a natural setting: the school environment. This allowed us to prove the generalization on phases of instruction, in which a self-control training had not been realized. Results of this study indicate, that self-controlled behavior generalizes to these other phases of instruction.

These observations are very important in the planning of educational programs. Apparantly it doesn't seem necessary to train students in all situations in which self-control is required. On the contrary it can be expected that training in self-contracting (e.g. specifying task criterion and reinforcement criterion) will help students regulate their behavior in learning situations similar to the trained one. If further studies should confirm our findings, it will be necessary to change a teacher directed learning environment toward active student participation. This may help students to organize their own learning and develop responsibility for themselves.

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Dr. Heinz Neukäter
Akademischer Rat
PH Ruhr, Fb II
Kreuzstr. 155
4600 Dortmund
W.-Germany